

Regionally Specific Environmental Regulations Affecting the Energy Sector

Resource Availability and Environmental Regulations Vary Throughout the Country

- Water
 - Clean Water Act
 - Navigable Waterways/Coast Guard
 - Endangered Species Act
- Land
 - Zoning (State and Local)
 - ESA
 - Potentially NEPA
- Air
 - Clean Air Act

Why does the **Clean Air Act** have such an impact on the location of new generation?

- Criteria Pollutants
 - SO_2 , NO_2 , Pb, CO, O_3 , and PM ($\text{PM}_{2.5}$ & PM_{10})
- Visibility Impacts
- Accountability for the impacts of emissions locally, and hundreds, even thousands, of miles away from the stack
- Hg & CO_2 (Not quite yet – except state level initiatives)

Point Source Emissions Have Local and Regional Impacts

- Ambient air quality at a given location depends on atmospheric conditions and emissions: transport, dispersion, atmospheric chemical reactions, wet and dry deposition, and thermal mixing layer conditions.
- Characterized in spatial and temporal terms:
 - Emissions (chemical composition, source, quantity)
 - Fate and transport (rates of reaction, deposition, dispersion)
 - Effects (affected entity, pathway, severity, duration, thresholds, i.e. chronic vs. acute)

Fumigation



Dispersion



New York City Thanksgiving 1966

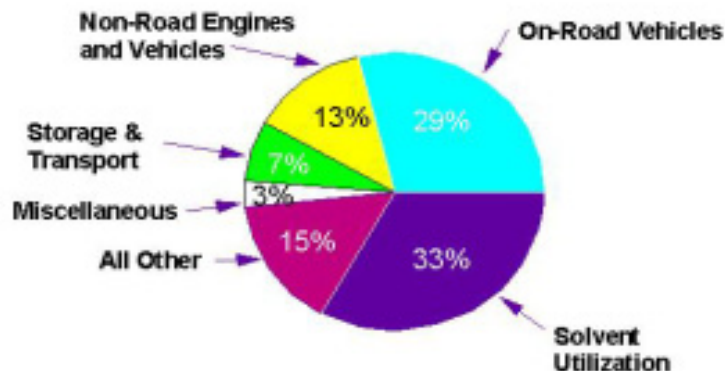


Where do ozone precursors originate?

- Air pollutants are “inventoried” according to emission sectors such as fuel combustion, solvent uses, etc..
- Examples of national emissions of VOCs and NO_x ... pollutants that form ozone.

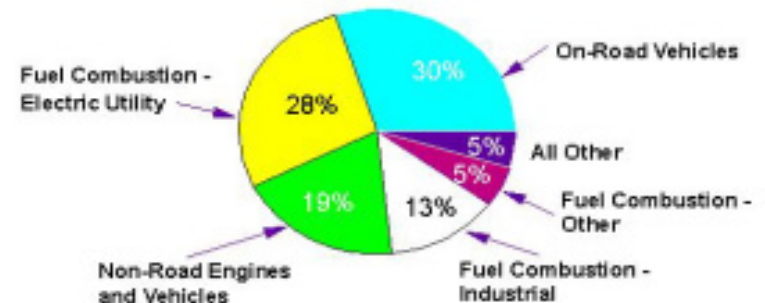
From where do the VOC emissions come?

National VOC Emissions by Source Category
(man-made)



From where do the NO_x emissions come?

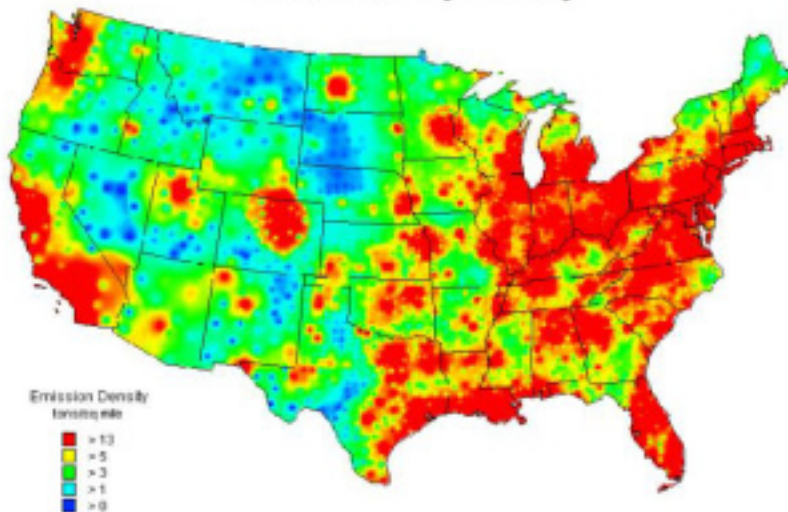
National Distribution of NO_x Emissions



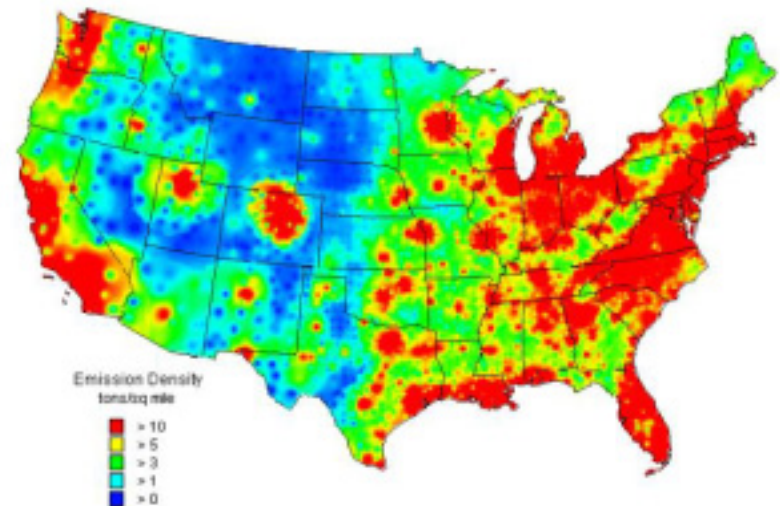
What are the sources of air pollutant emissions?

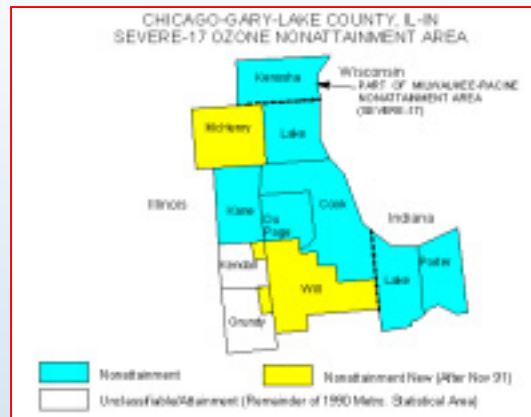
- The National picture of the distribution of NO_x and VOC emissions:

Density Map of 1998 NITROGEN OXIDE Emissions by County



Density Map of 1998 VOLATILE ORGANIC COMPOUND Emissions by County





Nonattainment Areas ...

➤ *any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant.*

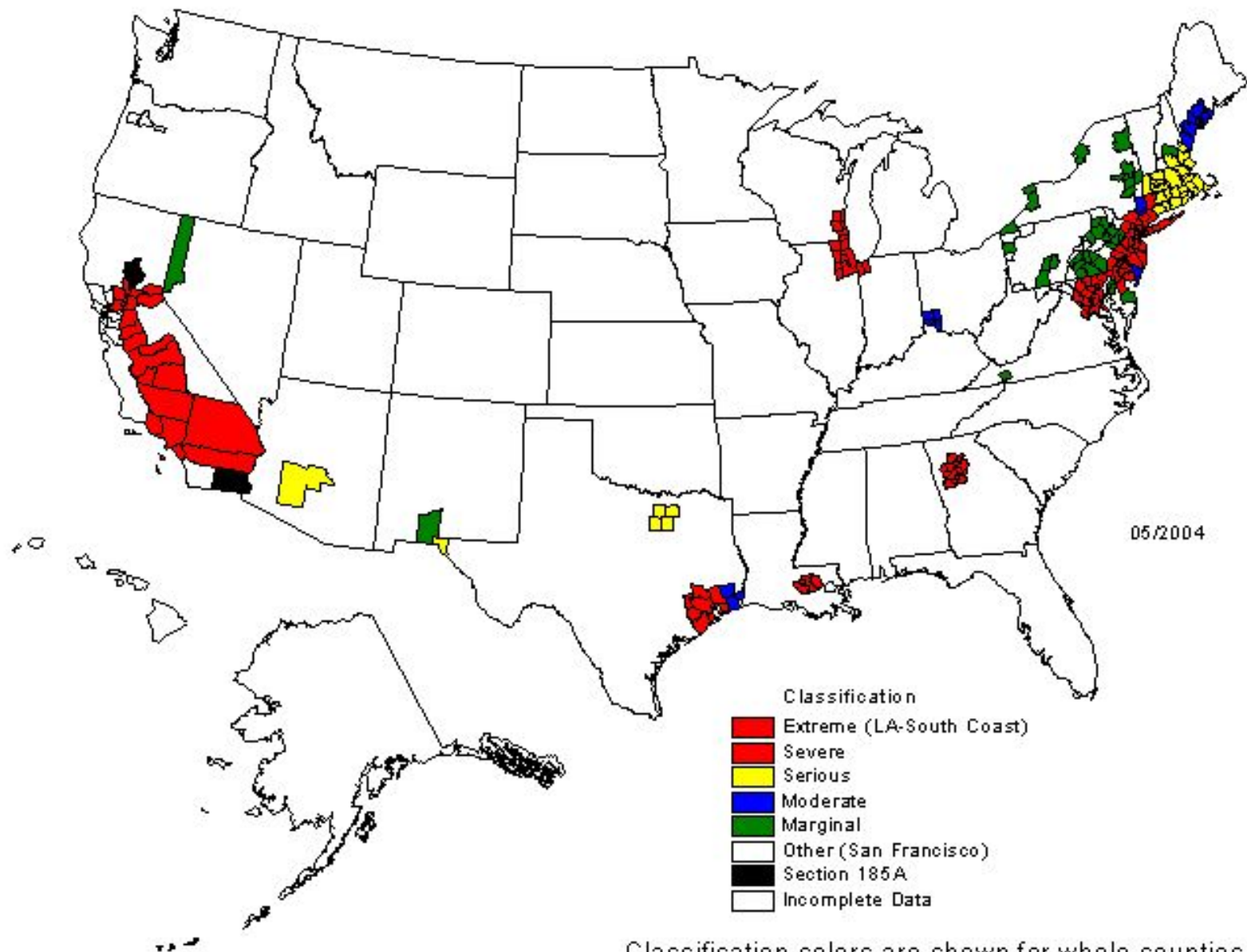
Sec. 107(d)(1)(A)(i) Designations



What are NA designations ... and what factors influence designations?

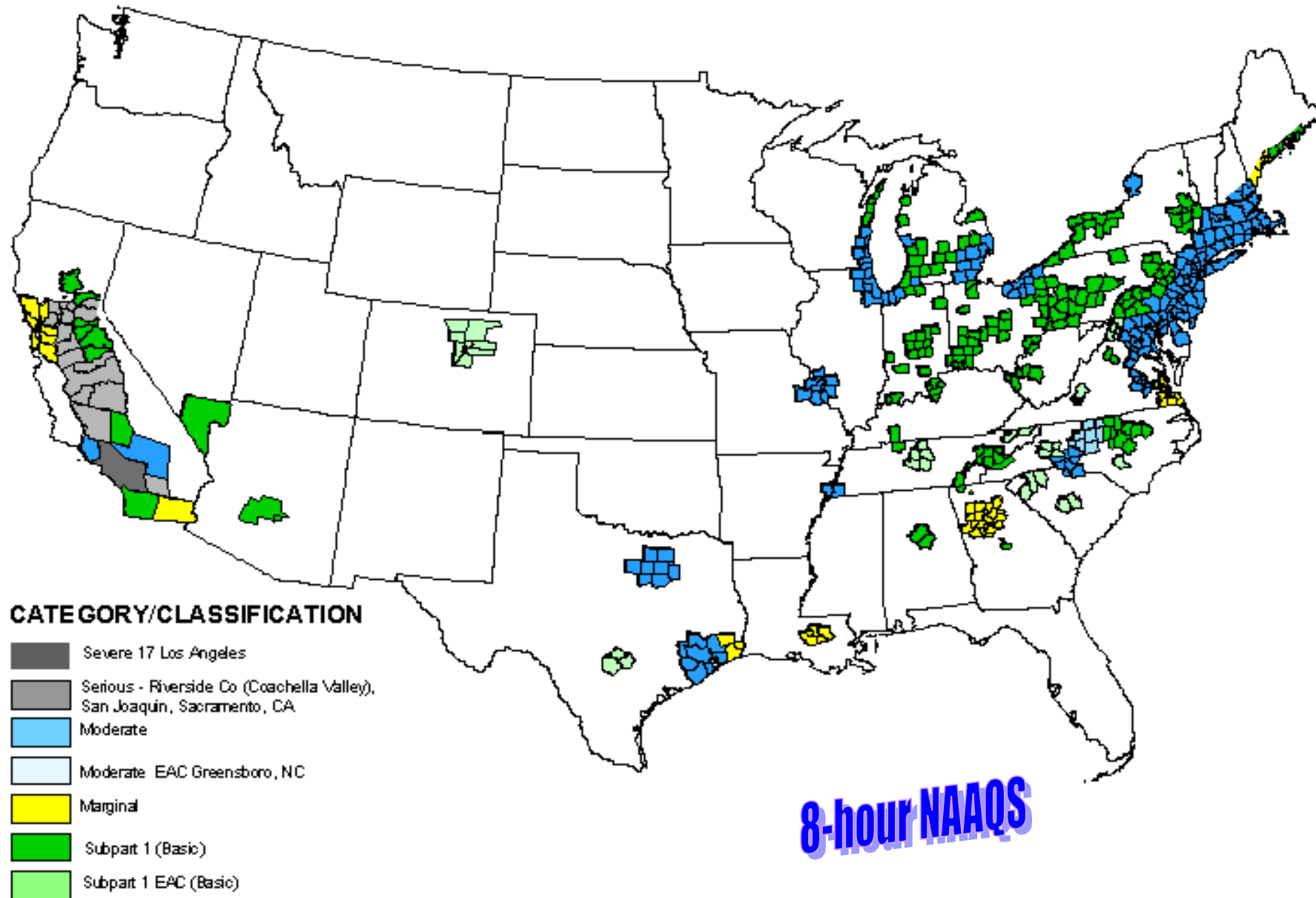
- Areas (often Consolidated Metropolitan Statistical Areas or smaller/larger) that are experiencing, or are contributing to air quality violations of the NAAQS are “designated” via EPA rulemaking as **NONATTAINMENT** for the pollutant in question ... 40CFR Part 81
- State clean air plans are generally due **3** years after formal designations.
- These plans (or SIPs) must demonstrate how control measures will attain the NAAQS by a future date, generally prescribed in the CAA ... the **ATTAINMENT DATE**

1-hour NAAQS Counties Designated Nonattainment for Ozone

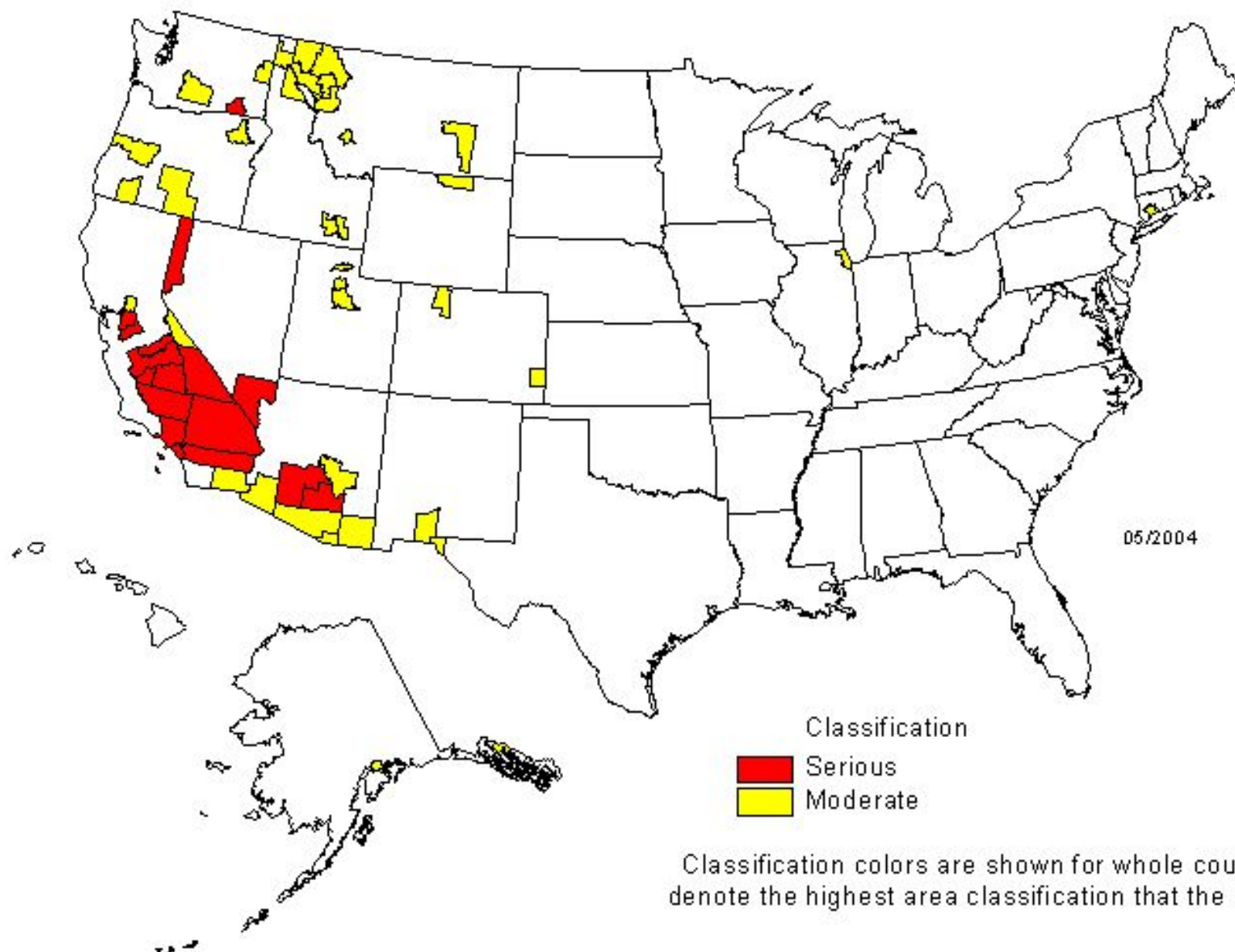


Classification colors are shown for whole counties and denote the highest area classification that the county is in

Classification of 8-hour Nonattainment Ozone Areas

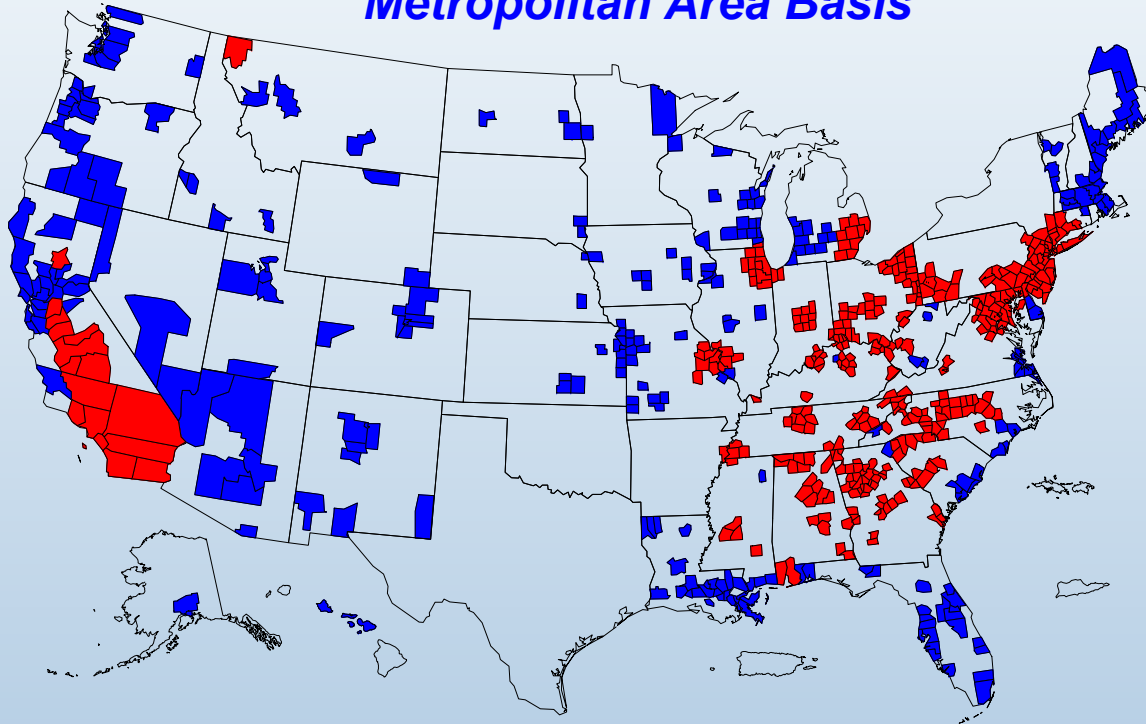


Counties Designated Nonattainment for PM-10



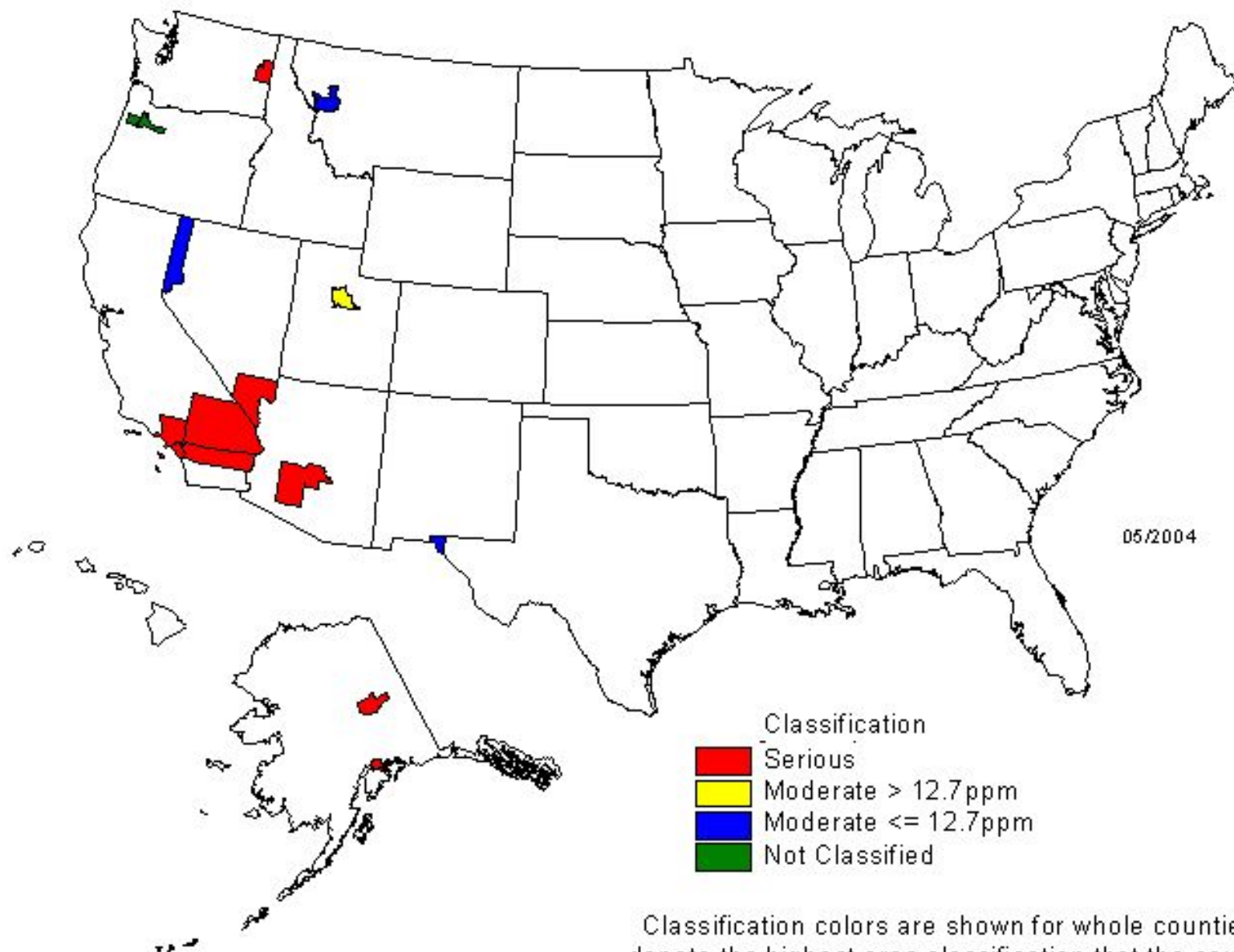
National PM_{2.5}

PM-2.5 Potential Nonattainment Areas (1999-2001 Data) Metropolitan Area Basis



- Counties in metro areas with at least 1 violating monitor
[369 counties, 112 million pop.]
- Counties in metro areas with highest monitor attaining the std.

Counties Designated Nonattainment for Carbon Monoxide

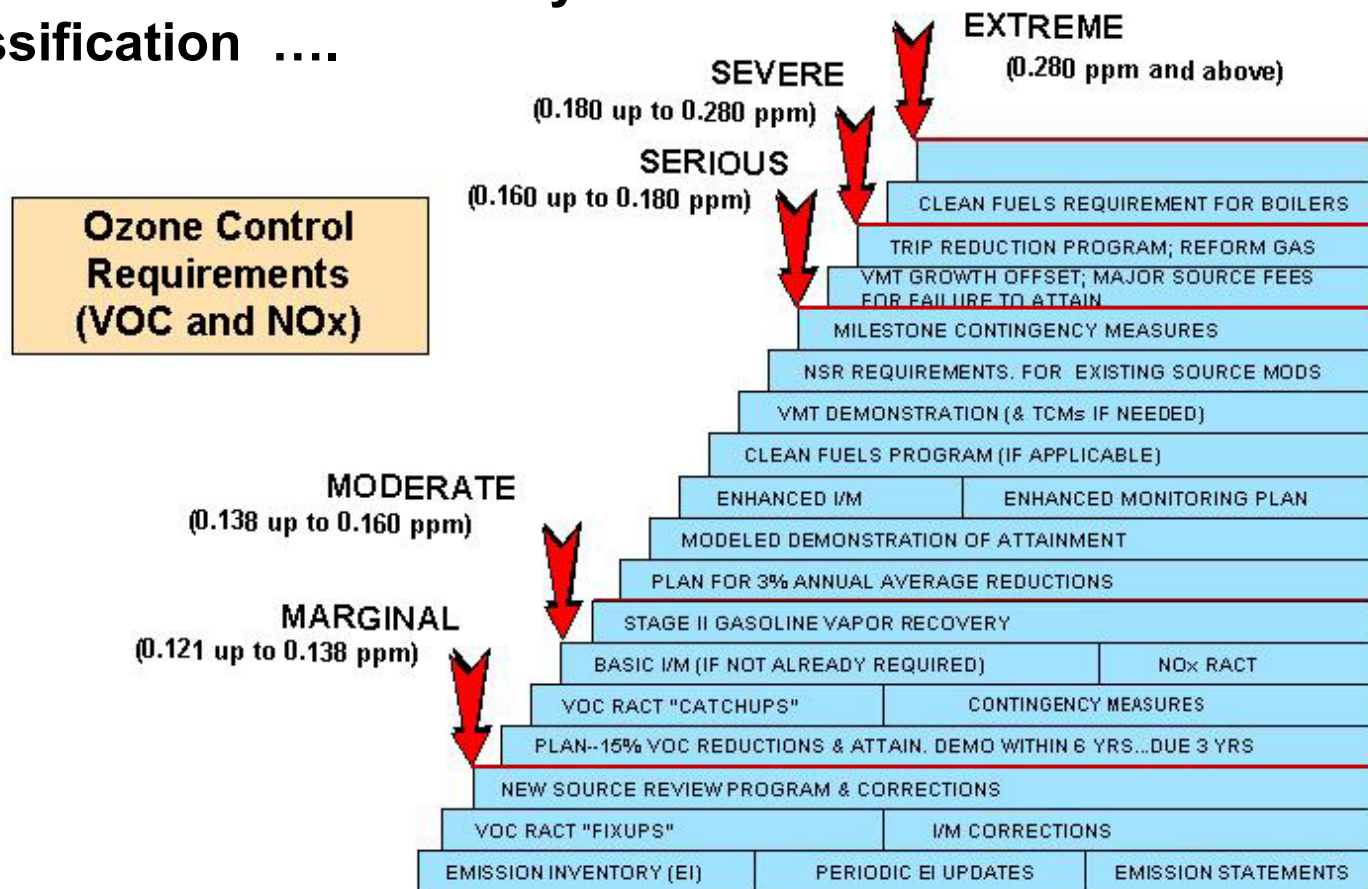


Implications of Non-Attainment Designations

- State required to submit a conforming SIP to EPA
 - Including air pollution mitigation measures
 - Regulatory framework (RACT, BACT, MACT, LAER)
 - Control strategies
 - Monitoring
- New plant siting becomes much more difficult
- Expansion of existing plants (capacity) also more difficult
- Existing sources may be required to invest in emission controls and monitors

Control measures that are placed in SIPs

- Mandated 1990 CAA controls by ozone classification



Other Spatial Factors Impacting the Siting for New Generation

- State & Federal Cap-and-Trade Program Areas
 - Acid Rain Program
 - OTC and NO_x SIP Call Programs
 - State Multi-Pollutant caps (SO₂, NO_x, CO₂, & Hg)
 - Proposed Rules (IAQR)
- Regional Planning Organizations established to address regional haze and related issues
- Planning and Administration: States, NESCAUM, EPA Administrative regions
- Proximity to Class 1 designated areas

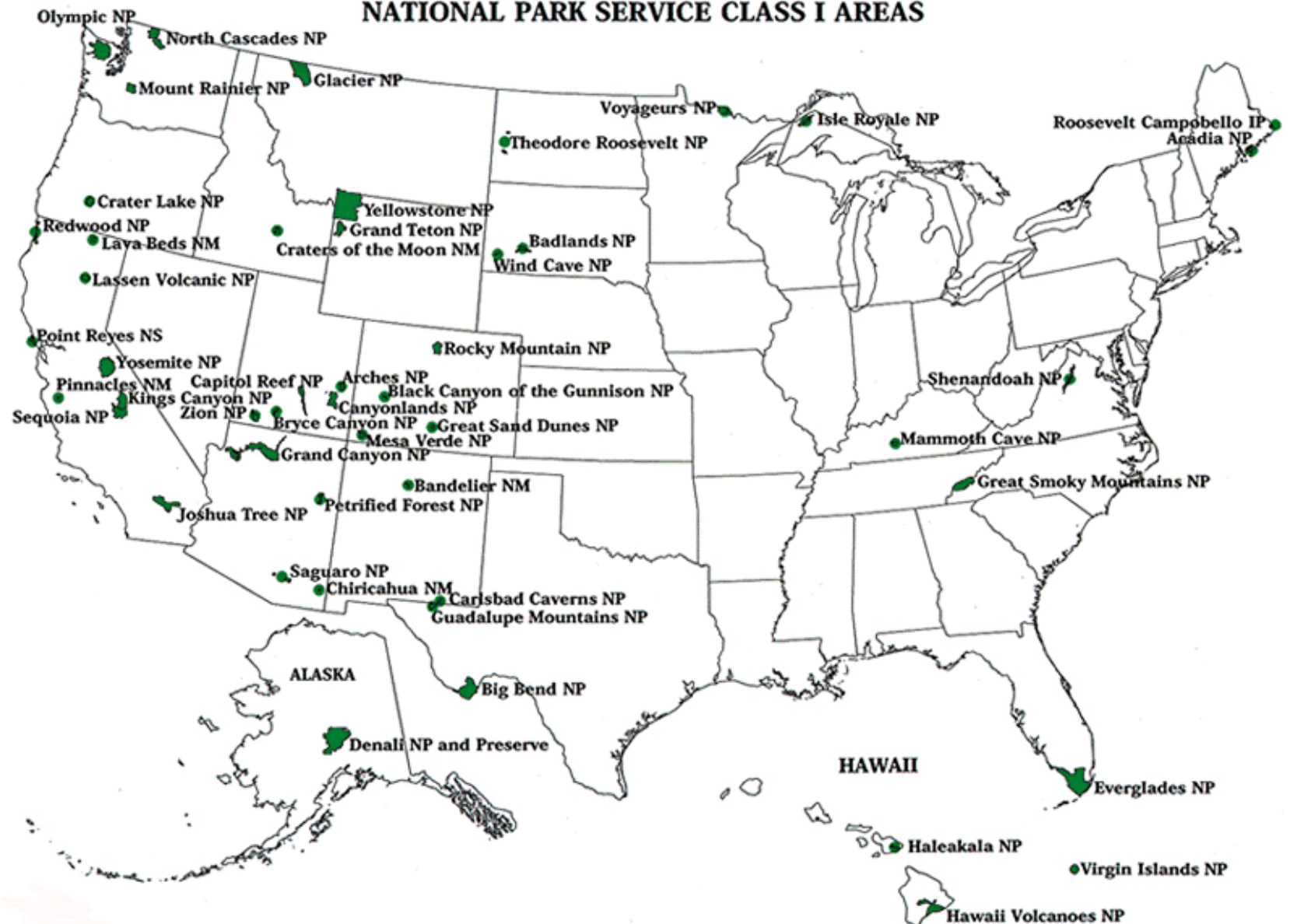
NO_x SIP Call States



http://www.epa.gov/ttn/naaqs/ozone/rto/about_3.html

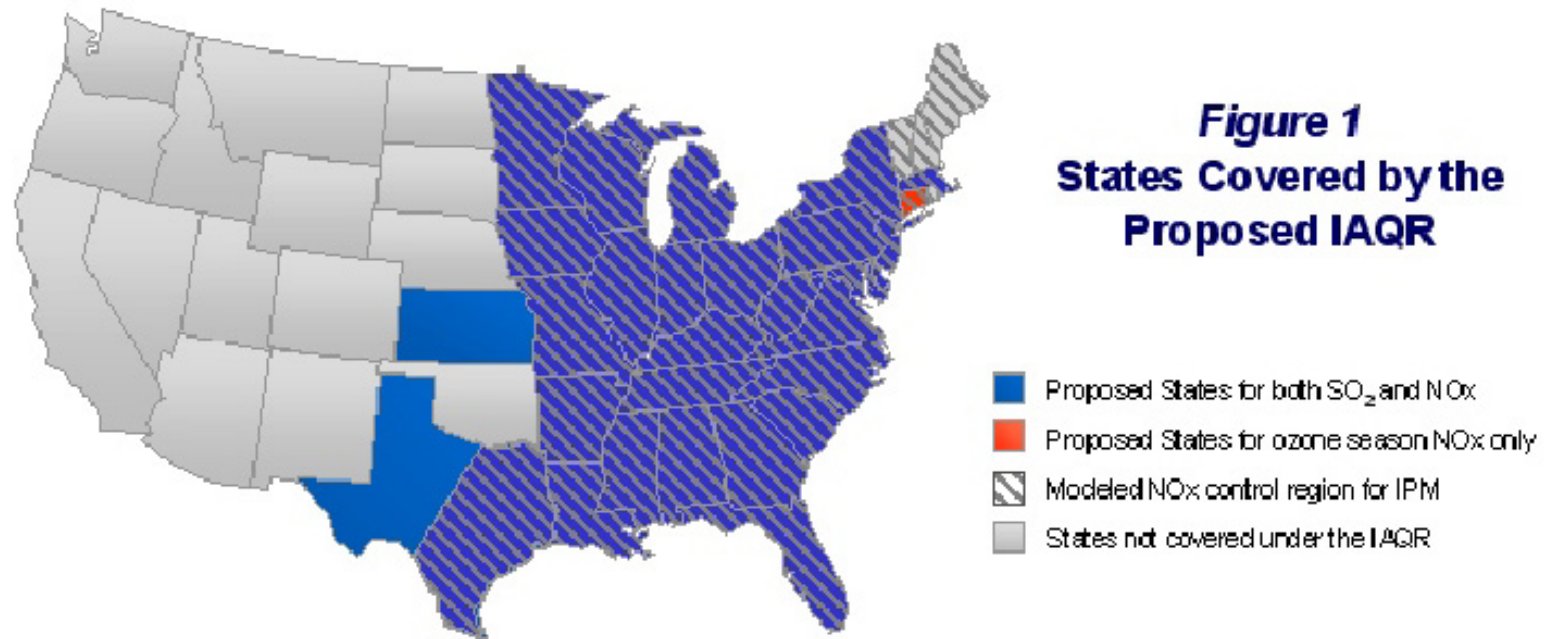
Requires 22 states plus District of Columbia to prepare SIPs aimed specifically at reducing NO_x

NATIONAL PARK SERVICE CLASS I AREAS



Interstate Air Quality Rulemaking

Figure 1
States Covered by the
Proposed IAQR



Projected SO₂ and NO_x Emissions and Reductions

<http://www.epa.gov/oar/interstateairquality/tm0009.pdf>

Evaluating Costs

- EPA is always required to conduct a Regulatory Impact Analysis for the Final Rules (includes economic analysis)
- Increased cost of electricity generation in NO_x SIP Call region estimated at 0.92 Mills/kWh (1990\$)
- The IAQR is projected to increase retail electricity prices by 2-3%

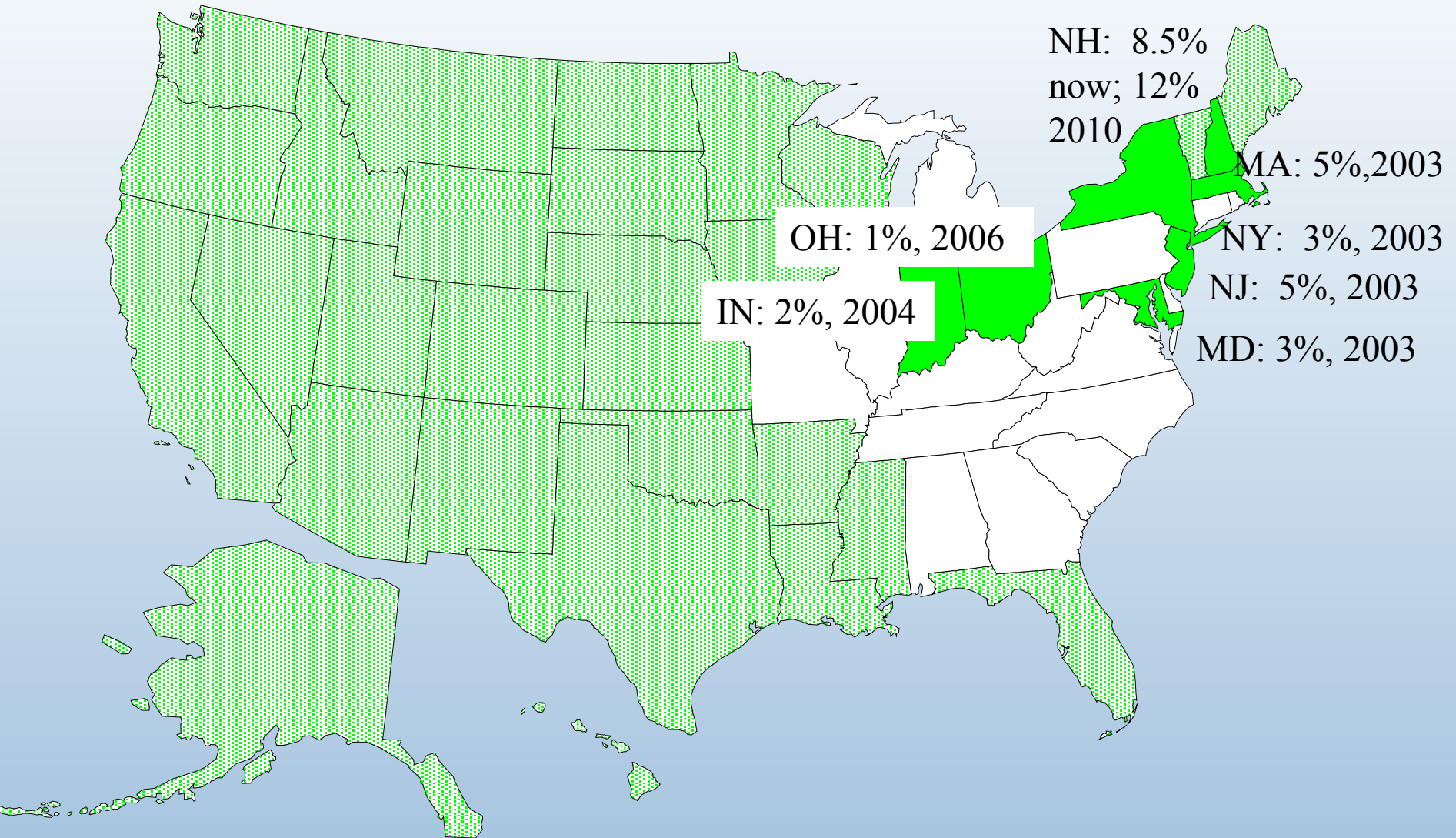
Potential Up-side to the Clean Air Act

- Energy suppliers can meet demand through:
 - Merchant Plants
 - DG
 - Cleaner Generation
- Emissions Credits offer a potential revenue stream
- EERE Set-Aside Opportunities

Emission Markets

- NO_x, SO_x, and VOCs (to a lesser extent) fall under various layers of cap and trade regimes depending on geographic location. There are also limits to the marketability of emissions credits due to the rules of these regimes – this isn't a true “open market”.
- ERC Markets: CA, TX, NY- PA, CT, ME, MA, RI
- Prices vary with supply and demand (\$2K - >\$100K)
- Downside to emission markets
 - Infrequent trades
 - ERC must be certified as valid by State environmental agency (quick and clear in some states, not so in others)

NOx EERE Set-Asides



Summary of the **Clean Air Act**

- Multiple layers of regulatory teeth
- Complex set of rules preventing the SIMPLE siting of new facilities or sources
- Dynamic - constantly being revised and updated
 - “...the Act requires EPA to review these standards [NAAQS] every five years with advice from the Clean Air Scientific Advisory Committee (CASAC)..”

Discussion

- How can the impacts of different air quality regulations be included in Regional models?
- Can the different layers of air quality regulations be combined into a single GIS application? Or has it already?
- Are there obvious sites where new generation can be sited?

Thanks to:

- Laura Vimmerstedt at NREL
 - Bill Baker and Tom Helms at EPA
- (Some photos and slides were borrowed from their presentations at the Air Innovations Conference in Washington, DC 03/12/04)

Contact Info:

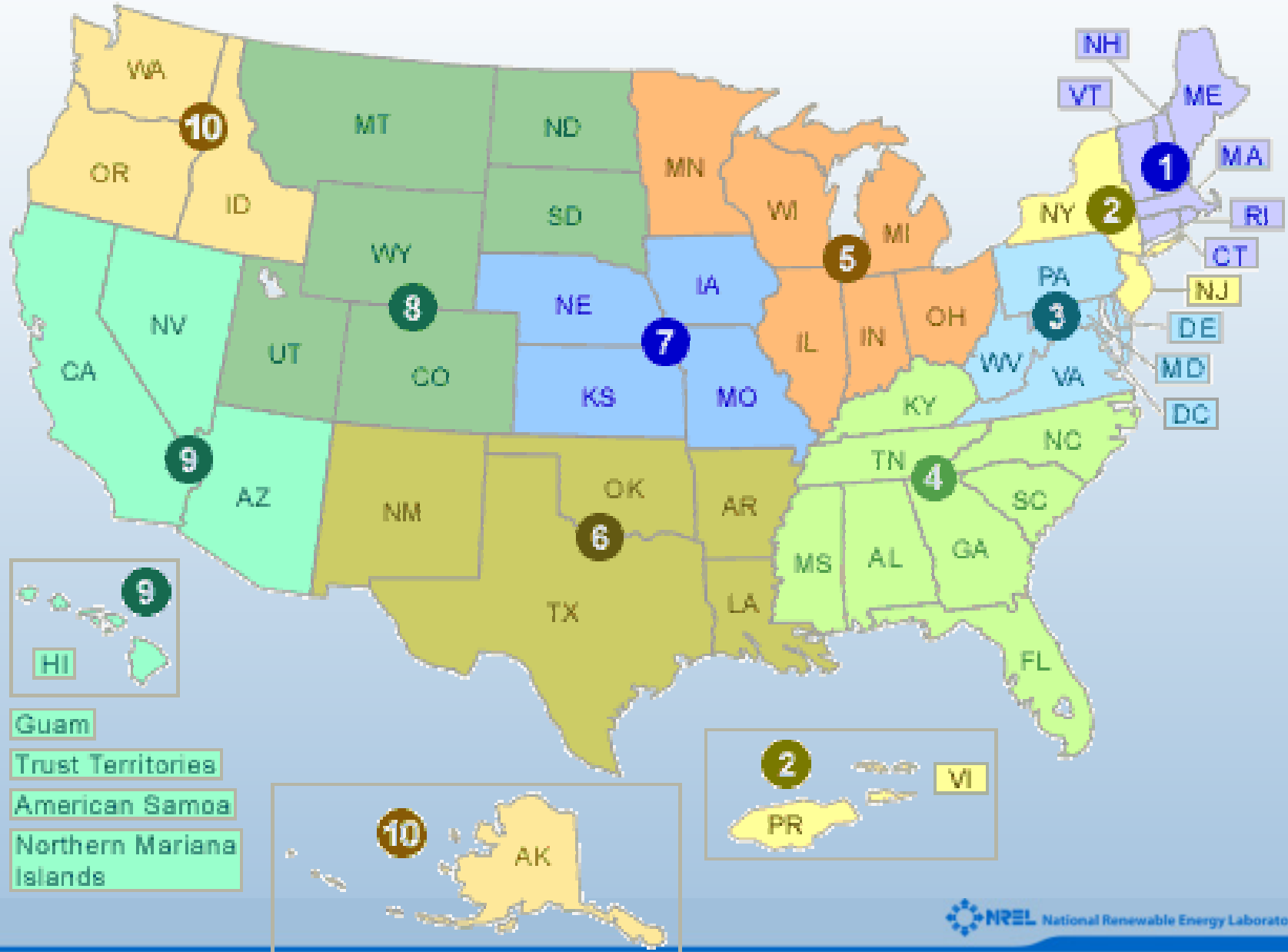
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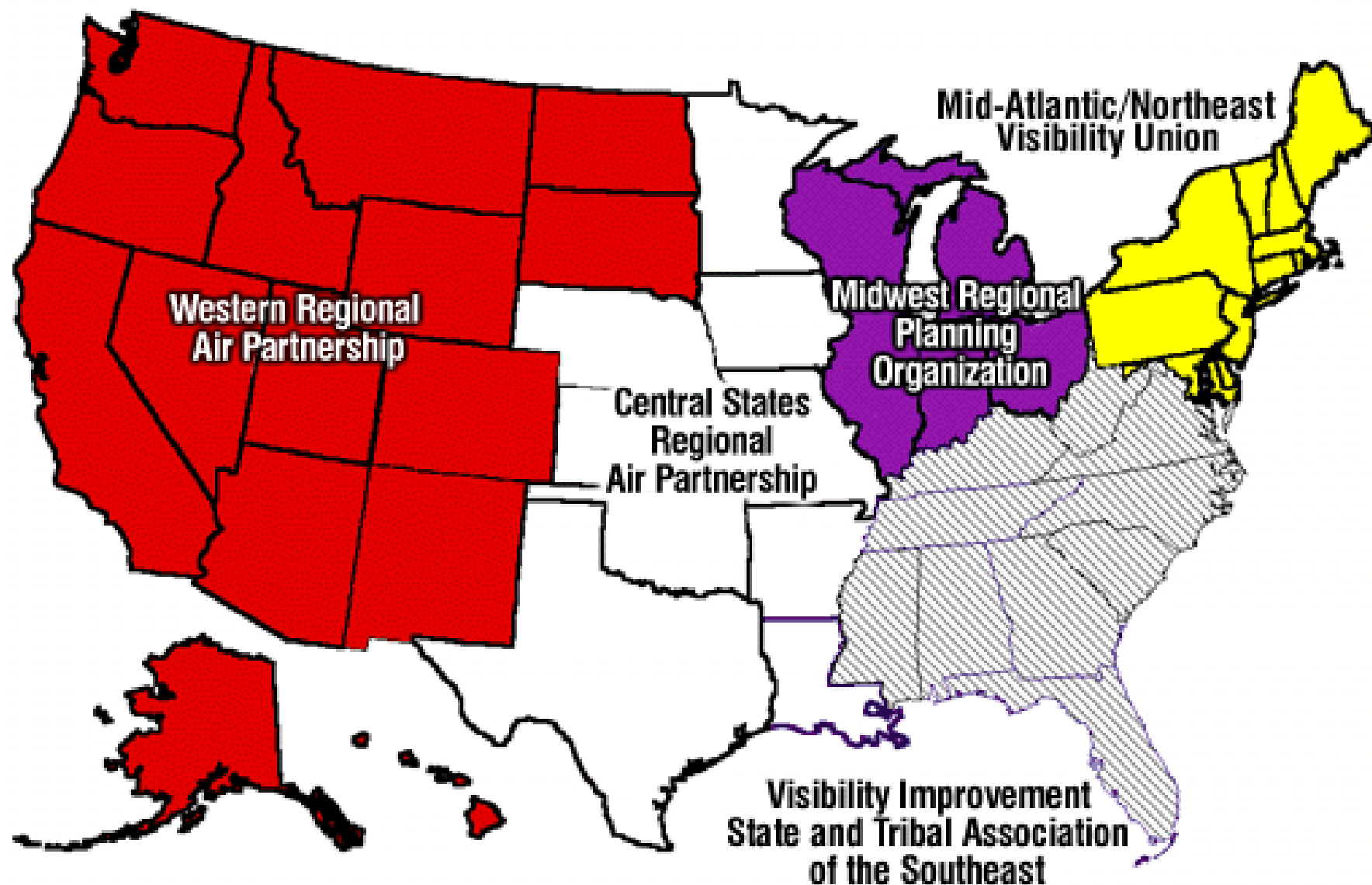
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Background Information and Maps

U.S. EPA Regions



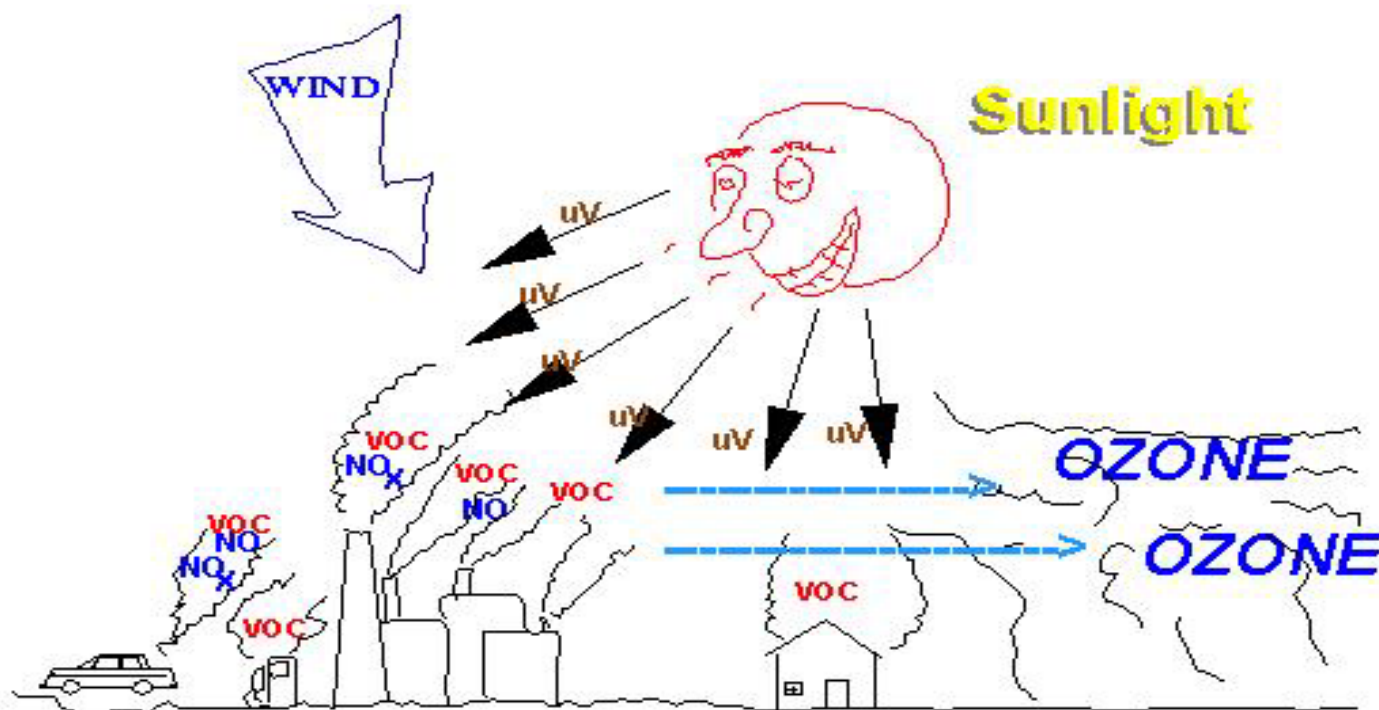
Regional Planning Organizations



Where does ozone come from?

HOW VOCs AND NO_x FORM GROUNDLEVEL OZONE

VOC + NO_x + SUNLIGHT = OZONE



EPA's National Ambient Air Quality Standards (NAAQS)

Carbon Monoxide (CO)

9 ppm (10 mg/m³)

Primary 8-hour Average

35 ppm (40 mg/m³)

Primary 1-hour Average

Nitrogen Dioxide (NO₂)

0.053 ppm (100 µg/m³)

Primary & Secondary Annual Arithmetic Mean

Ozone (O₃)

0.12 ppm (235 µg/m³)

Primary & Secondary 1-hour Average

0.08 ppm (157 µg/m³)

Primary & Secondary 8-hour Average

Lead (Pb)

1.5 µg/m³

Primary & Secondary Quarterly Average

Particulate (PM 10)

Particles with diameters of 10 micrometers or less

50 µg/m³

Primary & Secondary Annual Arithmetic Mean

150 µg/m³

Primary & Secondary 24-hour Average

Particulate (PM 2.5)

Particles with diameters of 2.5 micrometers or less

15 µg/m³

Primary & Secondary Annual Arithmetic Mean

65 µg/m³

Primary & Secondary 24-hour Average

Sulfur Dioxide (SO₂)

0.03 ppm (80 µg/m³)

Primary Annual Arithmetic Mean

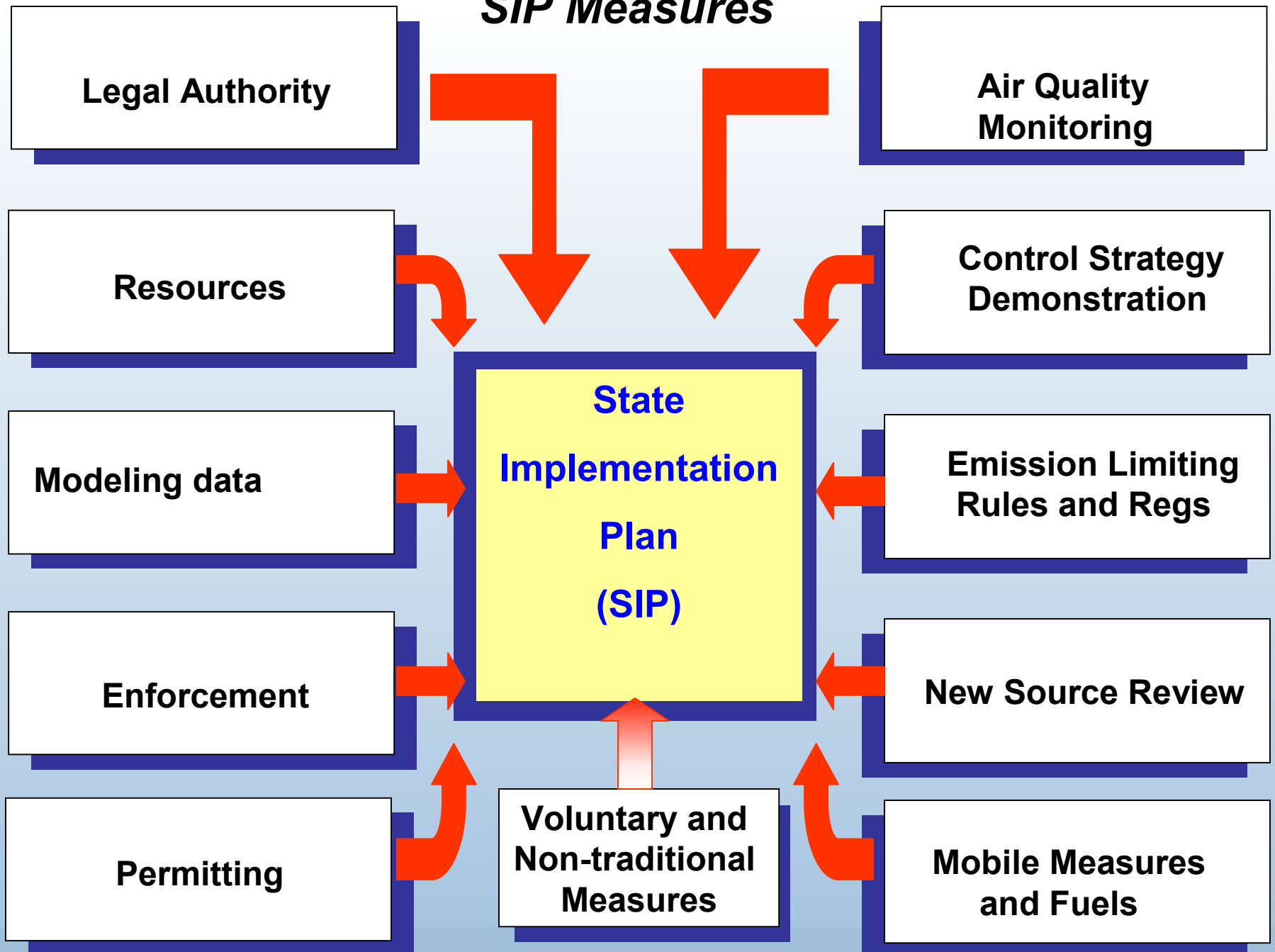
0.14 ppm (365 µg/m³)

Primary 24-hour Average

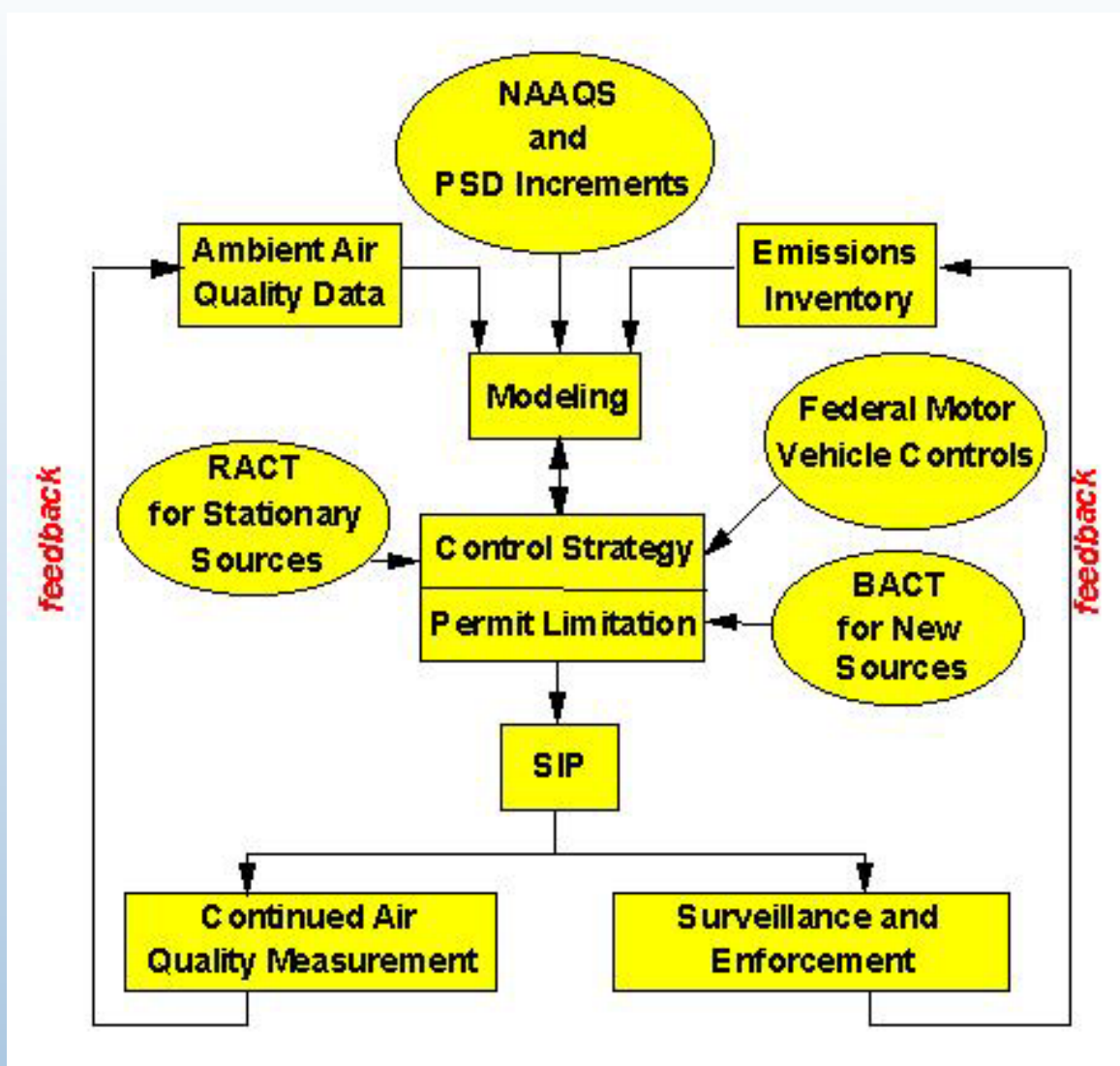
0.50 ppm (1300 µg/m³)

Secondary 3-hour Average

SIP Measures



*Actions
necessary
to plan for
and
achieve
clean air!*



Cost Example: Clean Air

Table 7
Retail Electricity Prices by NERC Region with the Base Case (No Further Controls) and with the Proposed IAQR
(Mills/kWh)

			Base Case			Proposed IAQR			Percent Change		
<i>Power Region</i>	<i>Primary States Included</i>	<i>2000</i>	<i>2010</i>	<i>2015</i>	<i>2020</i>	<i>2010</i>	<i>2015</i>	<i>2020</i>	<i>2010</i>	<i>2015</i>	<i>2020</i>
ECAR	OH, MI, IN, KY, WV, PA	57.4	51.2	55.0	56.6	53.4	58.6	58.8	4.3%	6.6%	3.9%
ERCOT	TX	65.1	54.4	64.5	66.3	54.7	65.1	66.8	0.5%	0.9%	0.8%
MAAC	PA, NJ, MD, DC, DE	80.4	58.5	67.5	74.1	60.3	70.2	75.4	3.1%	3.9%	1.7%
MAIN	IL, MO, WI	61.2	53.0	57.2	62.6	54.6	60.7	64.1	3.0%	6.1%	2.5%
MAPP	MN, IA, SD, ND, NE	57.4	54.5	50.9	49.0	55.4	51.9	49.8	1.7%	1.9%	1.7%
NY	NY	104.3	80.4	87.9	90.8	82.0	89.9	91.0	2.1%	2.3%	0.2%
NE	VT, NH, ME, MA, CT, RI	89.9	71.8	77.8	84.1	72.7	79.7	84.3	1.3%	2.5%	0.2%
FRCC	FL	67.9	71.1	70.2	68.6	72.2	71.2	69.8	1.5%	1.4%	1.7%
STV	VA, NC, SC, GA, AL, MS, TN, AR, LA	59.3	55.8	54.7	54.7	56.5	55.7	56.0	1.2%	2.0%	2.4%
SPP	KS, OK, MO	59.3	51.7	53.0	56.4	52.5	53.7	57.0	1.7%	1.4%	1.1%
PNW	WA, OR, ID	45.9	50.2	49.1	48.6	50.5	49.3	48.7	0.4%	0.2%	0.2%
RM	MT, WY, CO, UT, NM, AZ, NV, ID	64.1	62.9	64.4	65.5	63.5	64.6	65.8	1.0%	0.4%	0.4%
CALI	CA	94.7	96.0	97.0	97.5	96.5	97.2	97.8	0.5%	0.2%	0.3%
National	Contiguous Lower 48 States	66.0	59.5	62.2	63.9	60.6	63.8	65.0	1.9%	2.6%	1.7%

Source: Retail Electricity Price Model. 2000 prices are from EIA's AEO 2003.